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REVIEW ON PHARMACOLOGICAL ACTIVITY OF *BAUHINIA PURPUREA* L. FLOWER

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ABSTRACT: Medicinal plants are nature's gift to human being to have disease free healthy life. It plays a vital role to preserve our health. India is one of the most medico-culturally diverse countries in the world where the medicinal plant sector is part of a time honoured tradition that is respected even today. Medicinal plants are believed to be much safer. In our country, more than 2000 medicinal plants have been recognized. *Bauhinia purpurea* Linn. (Caesalpinaceae; butterfly tree) is an important medicinal plant with various traditional uses. The present article including the detailed exploration of phyto-pharmacological properties of *B. purpurea* is an attempt to provide a direction for further research.

INTRODUCTION: The well-known and well established genus Bauhinia comprises of trees and shrubs that grow in warm climate. It is rare in southern most districts, 5-7m tall tree in deciduous forests which is often planted in gardens along roadside for its large purple beat flowers. The leaves are 10–20 cm long and broad, rounded, alternate and bilobed at the base and apex. The flowers are conspicuous, pink, and fragrant, with five petals. The fruit is a pod 30 cm long, containing 12 to 16 seeds and have long seeds as pea. Flowers and fruits appear in the month of December. Synonyms/Common names of plant *Bauhinia purpurea*-Purple Orchid tree, Mandaram, etc. *B. purpurea* is native to South China (which includes Hong Kong) and South-eastern Asia and it is found throughout India, ascending to an altitude of 1300m in Himalaya.

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The different species of Bauhinia *viz*., *B. reticulata*, *B. rufescens* and *B. variegata* have been traditionally used to treat roundworm infections, conjunctivitis, anthrax, ulcerations, dysentery, blood-poisoning, leprosy, lung and skin diseases in Africa; while in India, extracts of the bark of *B. variegata* is used for treatment of cancer. Leaves are used as a plate for food and fodder during lean period, bark used as fibre, in dyeing and tannin extraction and its decoction is used as anthelmintic and in diarrhoea. The decoction of root is used for expelling gases, flatulence and gripping pain from the stomach and bowels. The decoction of flower works as a maturant for boils and abscesses. Root bark of *Bauhinia purpurea* L. Contains flavones glycoside. The present study was designed to investigate and evaluate the pharmacological basis for the use of *B. purpurea* in the folk medicine to expel the worms.

Morphological Character:

Botanical Name: *Bauhinia purpurea*

Common Name: Purple bauhinia, orchid tree, camel's foot tree, butterfly tree.

Hindi: Kota, raktakanchan, khairwal, karar, kanchan.

Malay: Tapakkuda

Nepali: Tanki

Spanish: Pie de cabra

Thai: Sieowaan,sieodokdaeng

Trade Name: Kachan, karar, khairwal

Scientific Classification:

Kingdom: Plantae

Clade: Tracheophyte

Division: Angiosperms

Order: Fabales

Family: Fabaceae

Genus: Bauhinia

Species: *B. purpurea*

Cultivation and Collection: Propagation of Bauhinia species is from seeds or cuttings. They thrive in alkaline soils and do not tolerate salty conditions. Full sun exposure is preferred but they can be grown under partial sun. Generous watering is needed during summer, moderate moisture required in winter. Cultivation and collection *Bauhinia variegata* can be naturally propagated through the seeds when provided with favorable conditions, whereas artificial propagation is carried out by stump planting *i.e.* direct sowing of seeds. Branch cuttings normally root with difficulty, but these root well in August, November and February with the application of auxins. Direct sowing can be done in lines, spaced about 3 m apart. Germination starts in about a week after the onset of monsoon rains ensuring good soaking of soil. The entire plants have to be transplanted with the ball of soil. For planting out in July-August, previous year's seeds are sowed in March April (Mali *et al.,* 2009). The ornamental plant is propagated with seeds, stem planting and branch cutting. Seeds are sown in March April. The seedlings are then transplanted in July-August. Their germination takes place on the onset of monsoon. *In-vitro* regeneration of was observed in *Bauhinia variegata* nodal explants from mature trees. Optimal shooting was obtained on media supplemented with 13.3 micrometre IBA within 15-20 days. Single shoots with 3-4 nodes initiates rooting when transferred to MS medium with 4.9 micrometre IBA within 45 days (Chandra *et al.*, 2007). Flowers: vasantharutu. Flowering: February-april. Fruiting: May-june (Chandra *et al.*, 2007.

TABLE 1: CHEMICAL CONSTITUENT

Plant parts	Chemical constitutents
Plant	*Bauhinia. Purpurea*l linn contain major class of secondary metabolites are glycosides, flavonoids, saponins, triterpenoids, phenolic compounds, oxepins, fatty acids andphytosterols
Leaves	Lupeol, stigmasterol, lanosterol, ergosterol, beta-tocopherol, phytol, hexadeconicacids, hexadeconic acids methyl esters, octadecadienoic acids and octadecatrienoic acid
Steambark	5,7dihydroxyand5,7dimethoxyflavanone-4-O-a-Lrhamnopyrosyl-ß-D-glycopyranosides, Kaempferol-3-glucoside, lupeol, and betasitosterol
Seeds	Protein, fattyoil-con-tainingoleic acid, linoleicacid, palmiticacid, andstearic acid
Flowers	Cyanidin, malvidin, peonidin, and kaempferol
Root	Flavanol-glycosides

TABLE 2: USES

Biological Activity	Plant Part	Extract/Formulation	Dose	Model/Organism/Celllines
Anti-diabetic	Bark	Methanolic	100mg/kg	STZ induced diabetes in rats alloxan-induce diabetes as say in mice
Anti-malarial	Root	Dichloromethan	5.8-11.2 micromolar	Against *plasmodium falciparum*
Cytotoxic	Leaves, bark, roots	Dichloromethane	10.5-72.3 micromolar	Brineshrimp lethality method of bioass, KB and BC cell lines
Anti-malarial	Root	Dichloromethan	5.8-11.2 micromolar	Against *plasmodium falciparum*
Antifungal	Root	Dichloromethane	49.6-130.1 micromolar	Against *candida albicans* employing a colorimetric method
Anti-mycobacterium	Root	Dichloromethane	-----	Against mycobacterium tuberculosis H37 Rausing the microplate Alamar Blueassay method
Amelioration of hyperthyroidism	Leaves	Ethanolic	100mgperkg	LT-induced hyperthyroid animals
Antimicrobial	Leaves	Aqueousorganic	----	Against microorganisms *Bacillus subtilis, Staphylococcus aureus, Salmonella typhi, Escherichiacoli, Pseudomonasa eruginosa* and *Candida albicans* using the disk diffusion method
Anti-diarrheal	Leaves	Ethanolic	100,200 and 300mg/kg	Castor oil induced diarrhea and gastrointestinal motility test by using charcoal meal
Fibrolytic	Bark	Powder	6 g/kg for 7days	In chronic mastitis with induced fibrosis
Antiepileptic	Leaves	Ethanolic	100,250 and 500mg/kgi.p	Using PTZ (pentylenetetrazole induced seizure) and MEZ (maximum electric shock)model
Anti-depressant	Leaves	Ethanolic	100,250 and500mg/kg.i.p	Using forced swim test and tail suspension test
Anti-inflammatory and anti-arthritic	Stembark	Hydro-alcoholic	100and 200mgperkg	Using Carrageenan induced paw edema and Adjuvant induced arthritis model
Antinoceptive, Anti-Inflammatory and Antipyretic activity	Leaves	Chloroform Aqueous	6, 30and 60mg/kg	formalin test, abdominal constriction and eddy's hotplate method and carrageenan induced paw edema method, brewer's yeast induced pyrexia test
Nephro-protective	Unripe pod /leaves	Ethanolic	300mgperkg	Gentamicin induced nephro toxicity
Wound healing	Leaves	Methanol and chloroform extract	100-500mg perkg	excisionwound, burn, deadspace wound and incision wound models
Antioxidant	Leaves	Aqueous	254mg/g and 143-138mg/g	By Nitricoxides cavenging assay, Reducing power method
Anti-ulcer	Leaves	Methanolic	100,500 and 1000mg/kg	Inducing gastric ulcer within do methac in, absolute ethanol and pylorus ligation.
Anti-hyperlipidemic	Unripe pods and dried leaves	Ethanolic	300 mg/kg/day	Induced with high fat diet
Anti-cancer	Roots, stems, pods and leaves	Bioactive compound	----	Inhibit P388 cancer cell line
Anti-Obesity	Bark	Methanolic	200and 400mg/kg	Induced with high fat diet
Hepatoprotective	Leaves	Methanolic	50,250and 500mg/kg	Induced by oral administration of paracetamol

Dosage:

Twakchurnam- 4 grams.
Pushpachurnam- 2 grams.

Decoction- 50-100 ml (Chandra *et al.*, 2007).

Stem bark powder- 3-6 grams Decoction- 40-80 ml Flower juice- 10-20 ml.

Flower juice for decoction- 20-30 ml (Chandra *et al.*, 2007).

Kanchanara guggulu- ½ Tula (Khare, 2007).

Bark powder- 2-4 masha.

Pushppa powder- 1-2 masha (Kumar, 2013).

Pharmacological Activity *Bahunia purpurea* L. Flower:

Antihelmintic Activity: The extracts of flower of *Bauhinia purpurea* L. exhibits moderate to significant Anthelmintic activity at the dose of 50-250 µg/ml. All the extracts were tested for anthelmintic activity, piperazine citrate was employed as reference standard. It has been observed that all the tested extracts showed mild to moderate anthelmintic activity. Extracts EtOAc and MeOHextract of flower of *Bauhinia purpurea* L.was found to be most active agents among the extracts. Also aqueous extract of flower of *Bauhinia purpurea* L. was showing good Anthelmintic activity.

Antimalarial, Antifungal and Antitubercular Activity: Root extract (*B. purpurea*) led to the isolation of eleven novel compounds named as Dihydrodibenoxepins and dihydrobenzofuran compounds. Dihydrodibenoxepins was evaluated and showed marked Anti-malarial with inhibitory concentration range 5.8-11.2 micromolar. However oxepins and dihydrobenzofuran showed potent Anti-fungal activity with inhibitory concentration range 49.6-130.1 micromolar. Antimycobacterium activity of root extract of B. purpurea was investigated against Mycobacterium tuberculosis H37Ra using the micro plate Alamar Blue assay method. The extract and its isolated bioactive compounds possessed profound antimycobacterium potential comparable with standard drug Isoniazid and kanamycin sulphate.

Antimicrobial Activity: Aqueous and organic extract of *B. purpurea* was investigated in organic and for antimicrobial activity against microorganisms *Bacillus subtilis, Staphylococcus aureus, Salmonella typhi, Escherichia coli, Pseudomonas aeruginosa* and *Candida albicans* using the disk diffusion method. Potent inhibitory activity was reported in methanolic extract of *B. purpurea.*

Anti-diarrheal Potential: Ethanolic extract of the leaves of *B. purpurea* was investigated for its anti-diarrheal potential in rats as experimental animal by using castor oil induced diarrhea and gastrointestinal motility test by using charcoal meal. The extracts at the doses of 100, 200, and 300 mg/kg were reported to possessed significant activity compared with the standard in both the models. The concluding remark of the study was the plant established its folklore claim

Antiepileptic (Anticonvulsant): Antiepileptic activity of ethanolic extract of *B. purpurea* on Swiss Albino mice using PTZ (pentylenetetrazole induced seizure) and MEZ (maximum electric shock) model at different doses was studied. The significant anticonvulsant activity was supported by marked decrease in duration of various phases of epilepsy like flexion, extensor, convulsion and stupor phases.

Anti-Depressant Activity: *B. purpurea* ethanolic leaves extract was investigated for antidepressant potential in Swiss Albino mice using forced swim test (FST) and tail suspension test (TST). Ethanol extract at the dose 100, 250 and 500 mg per kg and duration of immobility and mobility was evaluated for 4 minutes. Extract at 500 mg per kg when administered in mice produced fall in immobility time in TST and FST models. Action was reported comparable with standard antidepressant drug Imipramine.

Anti-inflammatory and Anti-arthritic Activity: Hydroalcoholic extract (stem bark) of *B. purpurea* was investigated for anti-inflammatory and antiartthritic activity on adult albino wistar rats using Carrageenan induced paw edema and Adjuvant induced arthritis model respectively. Rats and compared with standard lipid lowering drug atorvastatin. Hyperlipidemia was induced with high fat diet containing cholesterol, sodium cholate and coconut oil mixed with animal feed. On administering the extract as 300mg/kg/day orally for 30 days, authors reported modest increase in body weight accompanied by significant rise in serum HDL-C level, decrease in Total Cholesterol, LDL and Triglycerides level. Atherogenic Index, an important indicator of Congestive Heart Disease was also lowered with this dose.

Anti-cancer Activity: In significant studies, four new components were isolated from *B. purpurea*

roots, stems, pods and leaves, named bauhinia statins 1 to 4, chemically identified as dibenzo [b,f] oxepins (2a, 3-5). These four compounds were had significant growth inhibition against human cancer cell lines. Similarly, *Bauhinia statins* 1-(2a) indicated potential to inhibit P388 cancer cell line proliferation. The structure of new statins was established with Mass Spectroscopy and 2D NMR.

Hepatoprotective Activity: A study for hepatoprotective activity of *B. purpurea* employed methanolic extract of shade dried leaves on rats. Animals were divided into 6 groups designated as group I (normal control), group II (negative control),group III (positive control) and group IV,V,VI as pre-treatment group with 50 mg, 250 mg and 500 mg per kg body weight given orally, once daily for 7 days. Hepatotoxicity was induced by oral administration of paracetamol. Biochemical evaluation revealed decrease in ALT (alanine aminotransferase), AST (aspartate aminotranseferase) and alkaline phosphatase on treatment with extract and silymarin. Histopathologically, methanolic extract of B. purpurea reversed toxic effect of paracetamol, namely necrosis, inflammation and hemorrhage.

Anti-Obesity Activity: Methanolic extract of B. purpurea bark was administered orally as 200mg/kg and 400mg/kg body weight to Male Wistar rats on high fat diet for 6 weeks. Sibutramine, the standa decreased body weight of obese rats by 30%, while 28 % and 24% was weight reduction observed in rats due to 400mg/kg and 200 mg/kg body weight extract dose. At the end of treatment period, total cholesterol, triglycerides, low density lipoprotein level in blood serum decreased notably with parallel rise in high density lipoprotein level.

Fibrolytic Effect: *B. purpurea* bark powder on daily administration at the dose of 6 g/kg for 7 days was investigated for its fibrolytic effect in chronic mastitis with induced fibrosis. Experimental goats were divided into four groups, I and III animal group received ceftriaxone at 20 mg/kg intravenously, whereas group II and IV goats were orally administered with *B. purpurea* bark powder. Disease was reported to induce by using intramammary inoculation of coagulase positive *Staphylococcus aureus* in group III and IV goats. The authors concluded with the study that daily administration of bark powder enhanced the bioavailability of ceftriaxone due to its fibrolytic effect.

Amelioration of Hyperthyroidism: *B. purpurea* ethanolic leaves extract was investigated in an albino wistar rat model. LT4 inducing agent (0.5 miligram per kilogram) administered for 12 days exhibit rise in serum level of triiodothyronine, thyroxine concentration and decrease in thyroid stimulating hormone concentration. Concurrent administration of *B. purpurea* (100 mg per kg) extract to LT-induced hyperthyroid animals reversed all changes and supported to its potential in management of hyperthyroidism. Efficacy was reported as effective and comparable to that of reference drug Propylthiouracil [15]. Also, daily administration of *B. purpurea* at dose 2.5 mg/kg for 20 days increased serum T4 concentration and O2 consumption suggesting its role in Hyperthyroidism

Anti-diabetic Activity: Intraperitoneal administration of Streptozotocin (50 mg/kg) led to rise in levels of fasting blood glucose and maintained for 2 weeks. Daily administration of methanolic extract of *B. purpurea* at the dose of 100mg/kg produced a dose dependent decrease in blood glucose level [11]. The antidiabetic potential of different extract of stem and bark was also evaluated using Alloxan-induced diabetes assay in mice. Methanolic extract at the dose of 200 mg/kg was found to possessed significant anti-diabetic activity

Cytotoxic Activity: Study investigated different plant parts like leaves, bark and roots showed cytotoxic activity by implementing Brine shrimp lethality method of bioassay [13]. Bioactive compounds isolated from *B. purpurea* showed cytotoxic activity towards KB and BC cell lines with significant Inhibitory concentration value.

RESULT AND DISCUSSION: The review research on *B. purpurea* suggested a huge biological potential of this plant. It is strongly believed that detailed information as presented in this review on the phytochemical and various biological properties of the extracts might provide detailed evidence for the use of this plant in different medicines. The phytochemical variation

and efficacy of the medicinal values of *B. purpurea* are dependent on geographical locations. Even today, plant is the almost exclusive source of drugs for a majority of the world population. Therefore, it remains a challenge for the scientist to provide efficient, safe and cheap medication, especially for the rural area. These Bauhinia species and their quantification of individual phytoconstituents as well as pharmacological profile based on in vitro, *in-vivo* studies and clinical trial should be further investigated.

CONCLUSION: Developing country like India, herbal formulations forms a basis in primary health care for about 80% of the population as it gives fewer side effects due to its better compatibility with human body. From our results, it is understood that leaf and flower of *Bauhinia purpurea* contains chemical constituents, nutrients when tested qualitatively and quantitatively. Flower contains protein in higher concentration. While, the carbohydrate, amino acid content was higher in leaf. This shows that it might have a therapeutic potential which aids in the maintenance of good health. Kanchnara (*Bauhinia purpurea* Linn.) is the medicinal plant with a potential to cure various diseases.

We have discussed about the pharmacological activities, traditional, medicinal uses, cultivation, collection, chemical constituents and history of. The *Bauhinia purpurea* important chemical constituents present in it are flavonoids, glycosides, alkaloids, tannins and terpenoids which are responsible for different pharmacological properties of *Bahunia purpurea* L. Flower. In this review article, we have gathered information to represent the botanical, pharmacognostical, ethnobotanical, phytochemical and pharmacological literature on *Bauhinia purpurea* L. Flower.

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